

MARAIS DES CYGNES BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: Marmaton River
Water Quality Impairment: Dissolved Oxygen

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Marmaton

County: Bourbon, Allen and Crawford

HUC 8: 10290104

HUC 11 (HUC 14s): **010** (010, 020, 030, 040, 050, 060, 070 and 080)
 020 (010 and 020)

Drainage Area: 421 square miles

Main Stem Segment: WQLS: 5, 7, 8, 11, 12; starting at the state line and traveling upstream to headwaters near Moran (**Figure 1**).

Tributary Segments:

- Non-WQLS: Mill Creek (36)
 - Little Mill Creek (34)
- Non-WQLS: Wolverine Creek (35)
- WQLS: Cedar Creek (41)
- WQLS: Paint Creek (13, 14)
 - Bunion Creek (39)
 - Hinton Creek (38)
 - Owl Creek (45)
- Non-WQLS: Pawnee Creek (313)
 - Elm Creek(15)
- WQLS: Prong Creek (44)
- WQLS: Robinson Branch (40)
- WQLS: Walnut Creek (32)
- WQLS: Turkey Creek (33)
- WQLS: Tennyson Creek (31)
- WQLS: Wolfpen Creek (37)
- WQLS: Sweet Branch (30)

Designated Uses: Special Aquatic Life Support, Primary Contact Recreation; Domestic Water Supply; Food Procurement; Ground Water Recharge; Industrial Water Supply Use; Irrigation Use; Livestock Watering Use for Main Stem Segments.

Expected Aquatic Life Support and Secondary Contact Recreation on Cedar Creek, Paint Creek, Bunion Creek, Hinton Creek, Owl Creek,

Prong Creek, Robinson Branch, Walnut Creek, Turkey Creek, Tennyson Creek, Wolfpen Creek and Sweet Branch. Food Procurement on Paint Creek.

1998 303(d) Listing: Table 1 - Predominant Non-point Source and Point Source Impacts (559); Points Source Impacts (208)

Impaired Use: Aquatic Life Support

Water Quality Standard: Dissolved Oxygen: 5 mg/L (KAR 28-16-28e(c)(2)(A))

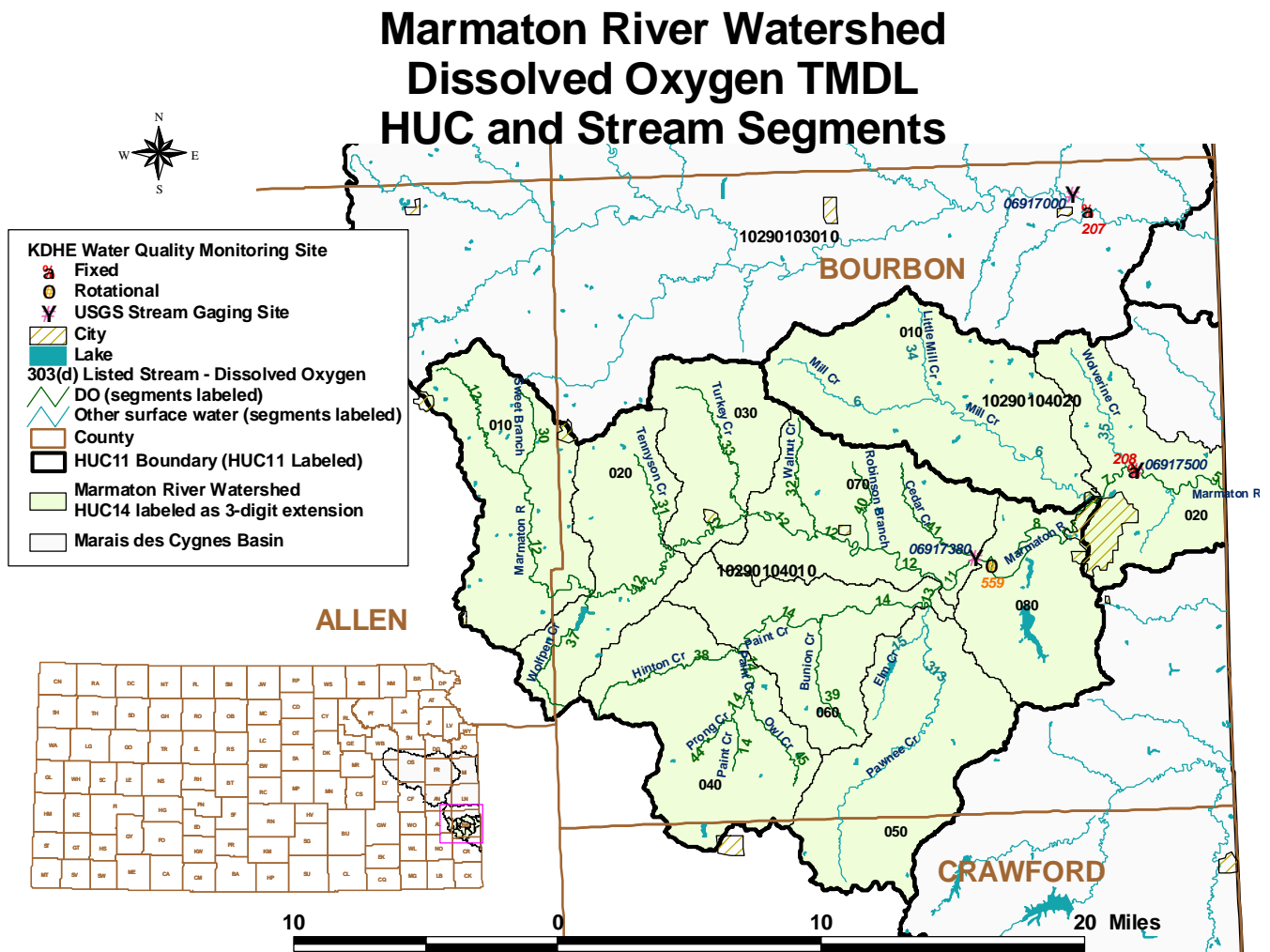


Figure 1

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Support for Designated Use under 1998 303(d): Not Supporting Aquatic Life

Monitoring Sites: Station 208 near Fort Scott (downstream site) and Station 559 near Fort Scott (upstream site)

Period of Record Used: 1985-2000 for Station 208 (**Figure 2**); 1990, 1994, 1998, 1999 and 2000 for Station 559 (**Figure 3**).

Flow Record: Site 208: calculated flow based on measurements at 06917550 (Marmaton R. near Kansas-Missouri state line); Site 559: Marmaton R. near Marmaton (USGS Station 06917380); 1970 to 1999.

Long Term Flow Conditions: 10% Exceedence Flows = 648 cfs, 7Q10 = 0.1 cfs

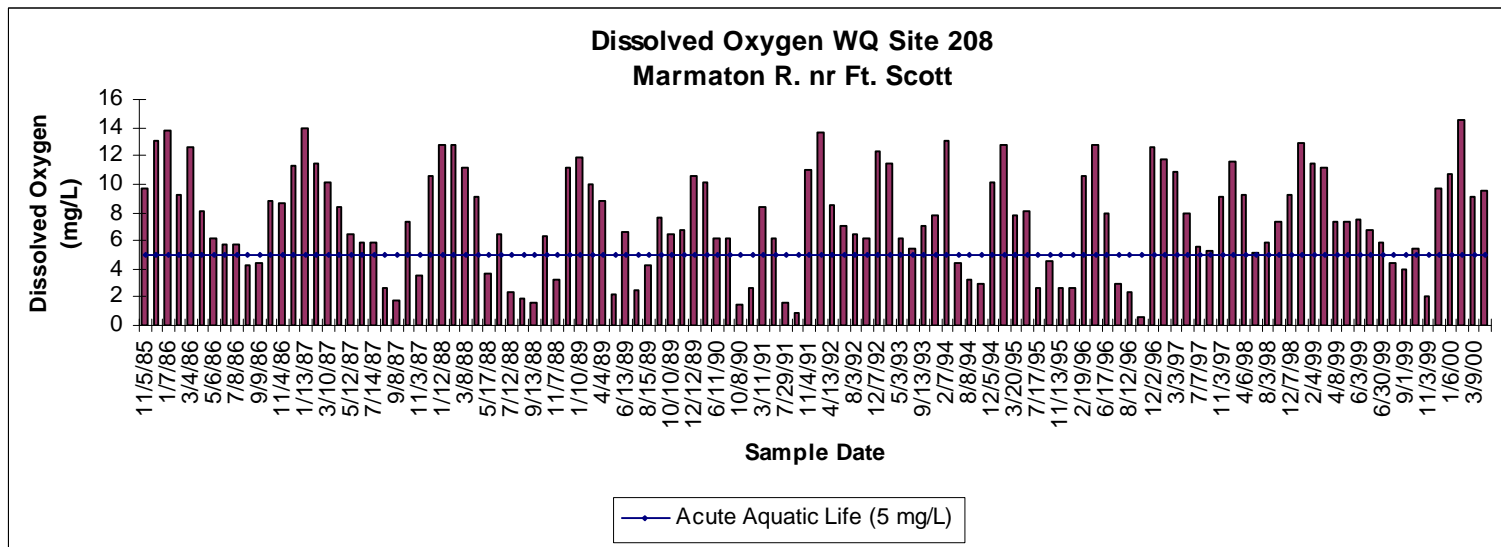


Figure 2

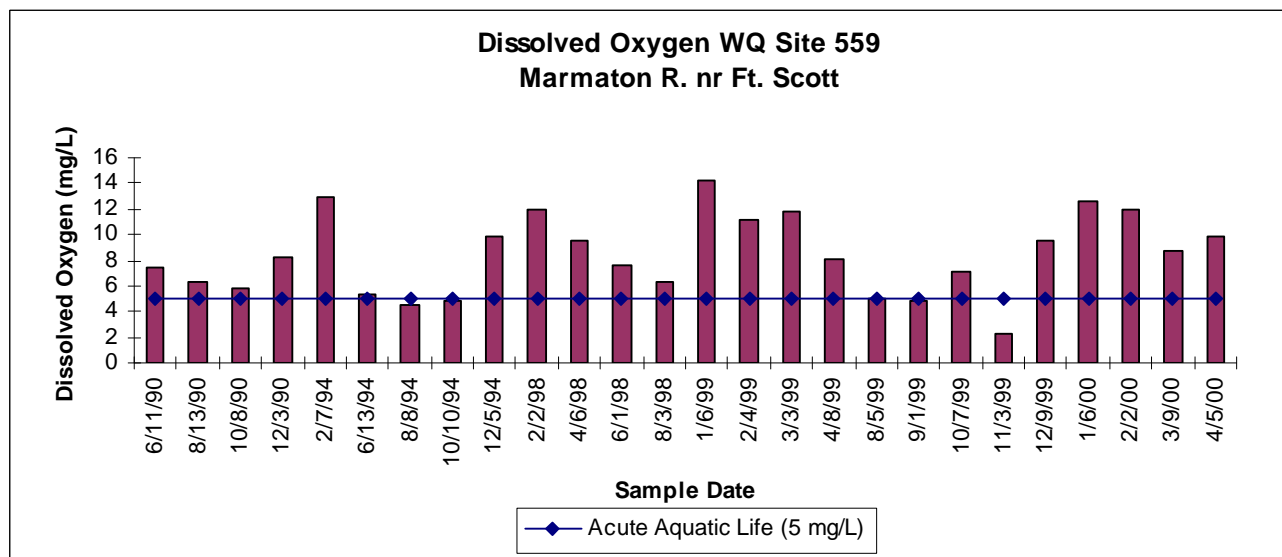


Figure 3

Current Conditions: Since loading capacity varies as a function of the flow present in the stream, this TMDL represents a continuum of desired loads over all flow conditions, rather than fixed at a single value. Sample data for each sampling site were categorized for each of the three defined seasons: Spring (Mar-Jul), Summer-Fall (Aug-Oct) and Winter (Nov-Feb). High flows and runoff equate to lower flow durations, baseflow and point source influences generally occur in the 75-99% range. Load curves were established for the Aquatic Life criterion by multiplying the flow values along the curve by the applicable water quality criterion and converting the units to derive a load duration curve of pounds of DO per day. This load curve graphically displays the TMDL since any point along the curve represents water quality at the standard at that flow. Historic excursions from WQS are seen as plotted points below the load curves. Water quality standards are met for those points plotting above the applicable load duration curves.

Water Quality Site 208: Excursions were seen in all three seasons and are outlined in Table 1. Eighteen percent of Spring samples and 53% of Summer-Fall samples were below the aquatic life criterion. Eleven percent of Winter samples were under the aquatic life criterion. Overall, 24% of the samples were under the criterion (**Figure 4**). This would represent a baseline condition of non-support of the impaired designated use.

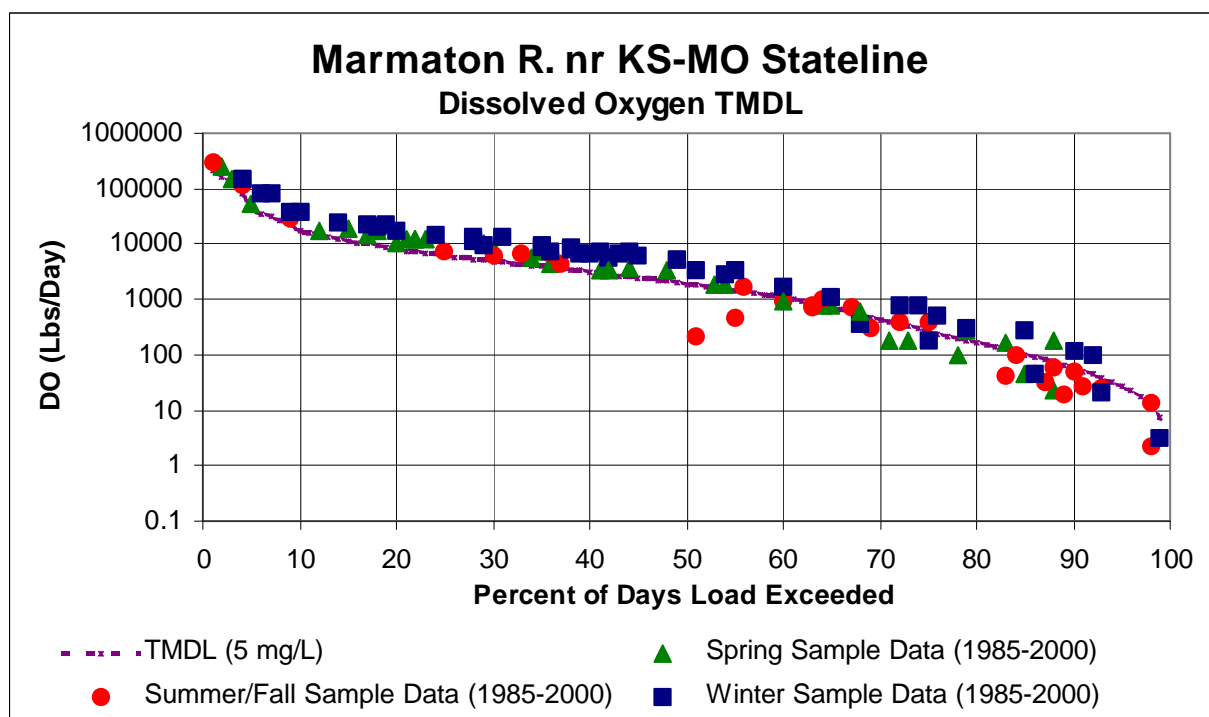


Figure 4

Water Quality Site 559: Excursions were seen in two of the three seasons and are outlined in Table 1. None of the Spring samples were below the aquatic life criterion. Thirty eight percent of the Summer-Fall and 8% percent of Winter samples were under the aquatic life criterion. Overall, 15% of the samples were under the criterion (**Figure 5**). This would represent a baseline condition of non-support of the impaired designated use.

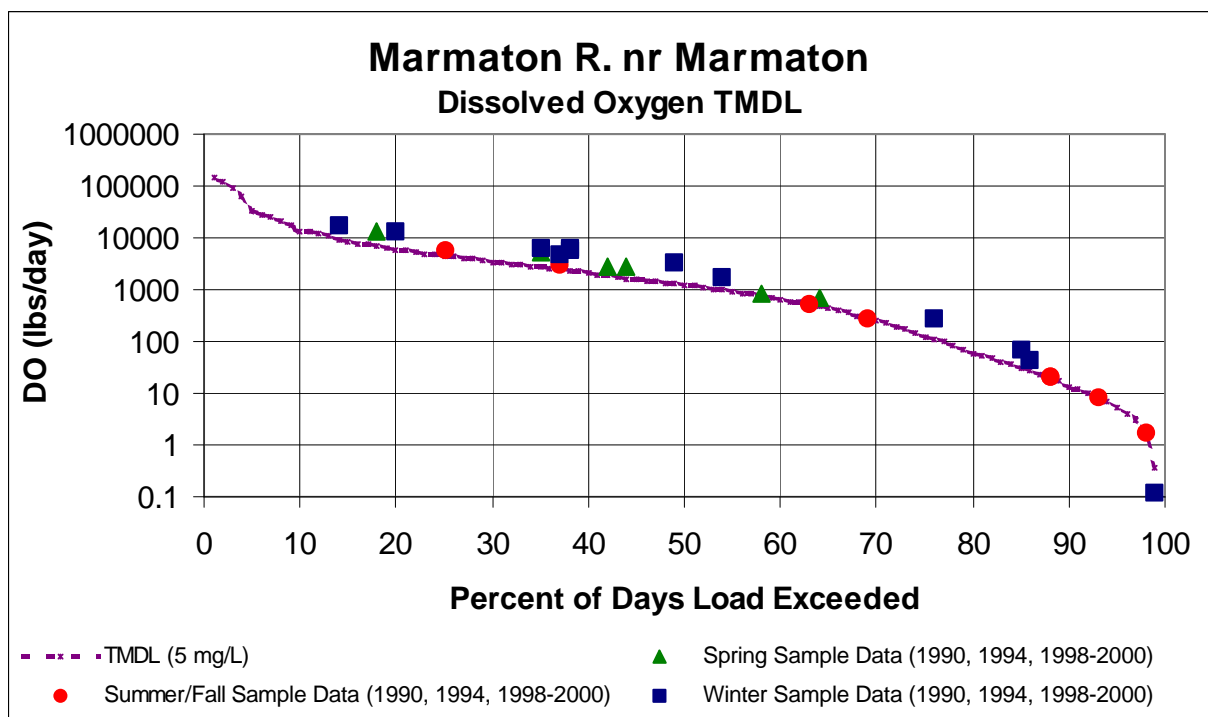


Figure 5

No DO violations have been encountered at flows exceeding 68 cfs on the Marmaton River near the state line, therefore a critical low flow can be identified on the Marmaton River as those flows of 68 cfs or less.

TABLE 1
NUMBER OF SAMPLES UNDER DISSOLVED OXYGEN STANDARD OF 5 mg/L BY FLOW

Station	Season	0 to 10%	10 to 25%	25 to 50%	50 to 75%	75 to 90%	90 to 100%	Cum Freq.
Marmaton R nr KS-MO State Line (208)	Spring	0	0	0	4	3	0	7/38 = 18%
	Summer	0	0	0	6	6	4	16/30 = 53%
	Winter	0	0	0	1	2	2	5/47 = 11%
Marmaton R. near Marmaton (559)	Spring	0	0	0	0	0	0	0/6 = 0%
	Summer	0	0	0	1	1	1	3/8 = 38%
	Winter	0	0	0	0	0	1	1/12 = 8%

A watershed comparison approach was taken in developing this TMDL. The Little Osage River watershed (Water Quality Sampling Site 207 in the watershed was not impaired by low DO) is of similar size, has similar land use characteristics and is located immediately north of the Marmaton River watershed. Not only were these two watersheds compared, but also the upper

(Site 559) and lower reach (Site 208) of the Marmaton River watershed were compared. The relationship of DO to Biochemical Oxygen Demand (BOD), water temperature, turbidity, nitrate, phosphorus and stream flow were used in the comparisons.

Table 2 outlines those water quality data for the samples taken on the same date for all three sites of interest between 1990 and 2000 when DO was below the aquatic life criterion for sample site 208.

At site 208 the average BOD, nitrate and total phosphorus concentrations for the samples were more than double that of sites 559 and 207 while average temperature, turbidity and flow were much the same. This indicates a significant nutrient load is being added to the river between site 559 and 208 and is likely the driving factor causing DO violations.

The average concentrations of BOD, nitrate and total phosphorus at sites 559 and 207 for these same samples were nearly identical indicating that, although there were DO excursions at site 559, these excursions were driven by climatic variables, natural in source; higher temperatures and/or extremely low stream flow.

TABLE 2

COL DATE	DO (mg/L)			BOD (mg/L)			TEMP Degrees C			TURBIDITY (FTU)			NITRATE (mg/L)			TPHOS (mg/L)			Flow (cfs)	
	WQ Site	WQ Site	WQ Site	WQ Site	WQ Site	WQ Site	WQ Site	WQ Site	WQ Site	WQ Site	WQ Site	WQ Site	WQ Site	WQ Site	WQ Site	WQ Site	WQ Site	WQ Site	USGS 0691- 7380	USGS 0691- 7000
	208	559	207	208	559	207	208	559	207	208	559	207	208	559	207	208	559	207	208, 559	207
10/8/90	1.5	5.8	5.7	10.1	2.5	2.5	16	15	14	32.4	26.4	11.8	0.9	0.05	0.08	0.3	0.1	0.06	0.68	4.3
12/3/90	2.6	8.2	8.3	3.2	1.6	2	4	4	3	10	5.4	7.5	0.55	0.01	0.04	0.44	0.06	0.08	0.97	1.4
6/13/94	4.4	5.3	5.7	7.3	3	2.4	22	22	22	45	19	30	0.65	0.54	0.63	0.18	0.08	0.12	29	88
8/8/94	3.3	4.5	8.2	8.6	5.8	5.9	23	24	22	15	6	9	0.42	0.01	0.01	0.19	0.07	0.12	0.33	3
10/10/94	3	4.9	6	9.7	3.2	3.8	13	13	12	13	5	11	2.06	0.01	0.01	0.19	0.03	0.06	10	0.49
8/5/99	4.4	5	7.5	4.23	2.01	2.1	28	26	29	34	37	16	0.38	0.34	0.01	0.2	0.24	0.08	19	4.8
9/1/99	4	4.9	4.9	1	1	1	26	25	26	18	10.7	10.1	0.22	0.07	0.09	0.15	0.07	0.07	0.77	0.34
11/3/99	2.1	2.3	3	7.1	3.3	3.8	11	10	10	10	3.4	5.6	0.34	0.01	0.01	0.19	0.11	0.11	0.01	0.41
AVERAGE	3.16	5.11	6.2	6.4	2.8	2.9	17.9	17.4	17.3	22.1	14.1	12.6	0.69	0.13	0.11	0.23	0.1	0.09	7.5	12.8

Desired Endpoints of Water Quality at Sites 208 and 559 over 2005 - 2009

The desired endpoint at Site 208 will be reduced biochemical oxygen demand from artificial sources such that average BOD concentrations remain below 2.9 mg/l in the stream under the critical flow conditions which results in no excursions below 5 mg/l of DO detected between 2005 - 2009.

This desired endpoint should improve DO concentrations in the creek at the critical lower flows (0-68 cfs) in the warmer months of the year (June-December). Seasonal variation is accounted for by this TMDL, since the TMDL endpoint is sensitive to the low flow and/or higher temperature conditions, generally occurring in the specified months.

This endpoint at Site 208 will be reached as a result of expected, though unspecified, reductions in nutrient/organic loading from the various sources in the targeted watershed resulting from implementation of corrective actions and Best Management Practices, as directed by this TMDL. Achievement of this endpoint will provide full support of the aquatic life function of the creek and attain the dissolved oxygen water quality standard.

At Site 559 the ultimate endpoint for this TMDL will be to achieve the Kansas Water Quality Standard for dissolved oxygen of 5 mg/l to fully support Aquatic Life.

Seasonal variation is accounted for at Site 559 by this TMDL, since the TMDL endpoint is sensitive to the low flow and/or higher temperature conditions, generally occurring in the Summer and Fall seasons.

This endpoint at Site 559 will be reached as a result of expected, though unspecified, improvements in riparian and tributary buffer strip conditions providing stream shade and filtering sediment before reaching the stream. Improvements to riparian and buffer strip conditions will result from implementation of corrective actions and Best Management Practices, as directed by this TMDL. Achievement of this endpoint will provide full support of the aquatic life function of the creek and attain the dissolved oxygen water quality standard.

Since BOD is not considered a factor in the occasional DO excursion at site 559, the BOD target will be to maintain the historical average in stream BOD of 2.4 mg/L or less at the sampling site.

3. SOURCE INVENTORY AND ASSESSMENT

NPDES: There are six NPDES permitted wastewater dischargers within the watershed (**Figure 6**). These systems are outlined in Table 3.

TABLE 3

DISCHARGING FACILITY	STREAM REACH	SEGMENT	DESIGN FLOW	TYPE
Bronson MWTP	Marmaton R. via unnamed tributary	12	0.064 mgd	Lagoon
Fort Scott Campground	Marmaton R.	7	0.00825 mgd	Lagoon
Fort Scott MWTP	Marmaton R.	7	3.0 mgd	Lagoon and Mech.
Maple Ridge MHP	Wolverine Cr.	35	0.0033mgd	Lagoon
Moran MWTP	Marmaton R. via unnamed tributary	12	0.098 mgd	Lagoon
Uniontown MWTP	Marmaton R.	12	0.045 mgd	Lagoon

Population projections for both Fort Scott and Uniontown to the year 2020 indicate modest growth. Projections for Bronson and Moran to the year 2020 indicate no change to slight declines. Projections of future water use and resulting wastewater appear to be within design

flows for each of the current system's treatment capacity. Examination of effluent monitoring indicates high levels of BOD from the Fort Scott treatment plant entering the stream system between site 559 and 208.

Livestock Waste Management Systems: Twenty three operations are registered, certified or permitted within the watershed. These facilities are beef, dairy or swine. Most of these facilities are either located in the southern third of the watershed or along the main stem reach (**Figure 6**). Potential animal units for all facilities in the watershed total 5,074. The actual number of animal units on site is variable, but typically less than potential numbers.

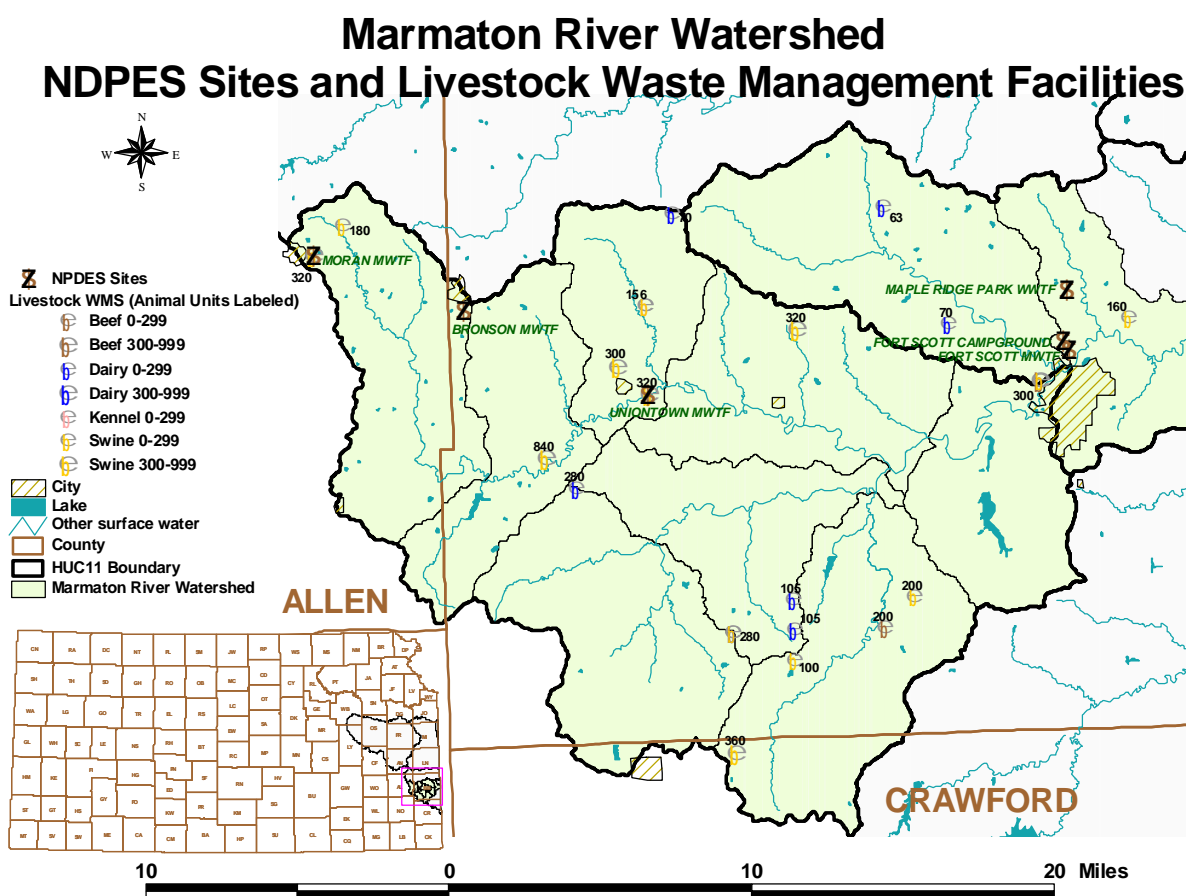


Figure 6

Land Use: Most of the watershed is grassland (49% of the area), cropland (40%), woodland (9 %) or urban use (1%). Most of the grassland is located around the perimeter (higher elevations) of the watershed. Based on 1998 water use reports, less than 1% of the cropland in the watershed is irrigated. The grazing density estimate is high (43-71 animal units/mi²) when compared to densities in the Marais des Cygnes and Missouri Basins (**Figure 7**).

On-Site Waste Systems: Most of the watershed's population density is low (5 - 17 persons/mi²) when compared to densities across the Marais des Cygnes and Missouri Basin except for areas

associated with the city of Fort Scott (74-185 persons/mi²) (**Figure 7**). The rural population projections for Allen and Bourbon County through 2020 show slight growth (3 and 12% increase, respectively).

Marmaton River Watershed Land Use, Grazing Density and Population Density Maps

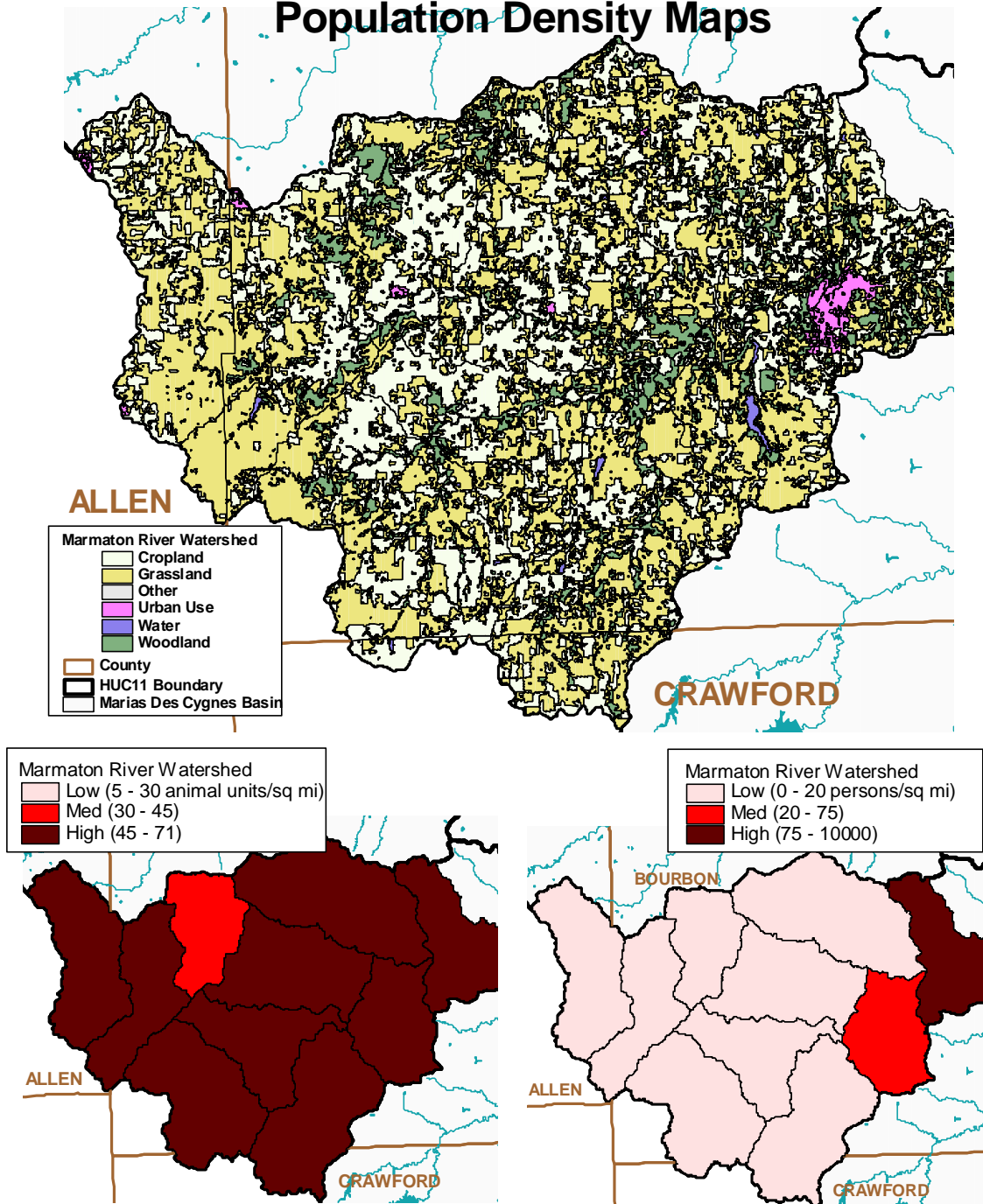


Figure 7

Contributing Runoff: The watershed's average soil permeability is 0.9 inches/hour according to NRCS STATSGO data base. More than 99% of the watershed produces runoff even under relative low (1.71"/hr) potential runoff conditions. Under very low (1.14"/hr) potential conditions, this potential contributing area is reduced to about 77%. Runoff is chiefly generated as infiltration excess with rainfall intensities greater than soil permeabilities. As the watersheds' soil profiles become saturated, excess overland flow is produced. Generally, storms producing less than 0.57"/hr of rain will generate runoff from 56% of this watershed, chiefly from the lower two thirds of the watershed and along the stream channels.

Background Levels: Some organic enrichment may be associated with environmental background levels, including contributions from wildlife and stream side vegetation, but it is likely that the density of animals such as deer is fairly dispersed across the watershed and that the loading of oxygen demanding material is constant along the stream. In the case of wildlife, this loading should result in minimal loading to the streams below the levels necessary to violate the water quality standards. In the case of stream side vegetation, the loading should be fairly constant along the stream and does not explain the two-fold increase in BOD, nitrate and total phosphorus from sampling site 559 to 208.

4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

It is presumed that reductions in BOD loads will reduce DO excursions under certain critical flow conditions. Therefore, the allocation of wasteloads and loads will be made in terms of BOD reductions. Yet, because DO is a manifestation of multiple factors, the initial pollution load reduction responsibility will be to decrease the BOD over the critical range of flows encountered on the Marmaton River. These reductions have been based on the relationship between DO and BOD for the samples taken at Water Quality Monitoring site 208 as compared to the relatively unimpaired Little Osage River watershed and its water quality monitoring site 207. Allocations relate to the BOD levels seen in the Marmaton River at site 208 relative to site 207 for the critical lower flow conditions. Based on this relationship, BOD concentrations at site 208 need to be reduced by 54% (so that in stream average BOD is 2.9 mg/L). Additional monitoring over time will be needed to further ascertain the relationship between BOD reductions of point and non-point sources, flow conditions, water temperatures and DO levels along the stream. Since average BOD is nearly the same at site 559 in the upper portion of the Marmaton River watershed as that of the unimpaired Little Osage River watershed and site 207, the BOD target is set to the historical sample average BOD at site 559 (2.4 mg/L).

For this phase of the TMDL, the average condition is considered across the seasons, to establish goals of the endpoint and desired reductions. Therefore, the target average BOD level was multiplied by the average daily flow estimated for the Marmaton River across all hydrologic conditions. This is represented graphically by the integrated area under each BOD load duration curve established by this TMDL. The area is segregated into allocated areas assigned to point sources (WLA) and nonpoint sources (LA). Future growth in wasteloads should be offset by reductions in the loads contributed by nonpoint sources. This offset along with appropriate limitations should eliminate the impairment. This TMDL represents the "Best Professional Judgment" as to the expected relationship between physical factors, organic matter and DO.

Point Sources: The point sources are responsible for maintaining their systems in proper working condition and appropriate capacity to handle anticipated wasteloads of their respective populations. All point sources contributing oxygen demanding substances within the watershed appear to be within their respective design flows for their populations through 2020. The State and NPDES permits will continue to be issued on 5 year intervals, with inspection and monitoring requirements and conditional limits on the quality of effluent released from this facility. Ongoing inspections and monitoring of the systems will be made to ensure that minimal contributions have been made by this source.

Based upon the preceding assessment, those point sources (Fort Scott, Fort Scott Campground and Maple Ridge MHP) contributing a BOD load to the Marmaton River between site 559 and 208 will be considered in the Wasteload Allocation at site 208. Streeter-Phelps analysis indicates the present BOD permit limits for each point source maintains DO levels above 5 mg/L for flows greater than or equal to the 7Q10 of 0.1 cfs and, until additional in stream monitoring can further define the DO/BOD relationship, is therefore assumed to correspond to maintaining an average of BOD of less than 2.9 mg/L at the sampling site across this flow condition and achieves the Kansas Water Quality Standard for DO of 5 mg/L. The sum of the design flows of the point sources (4.66 cfs) redefines the lowest flow seen at site 208 (83-99% exceedence), and the WLA (plus a background LA) equals the TMDL curve across this flow condition (**Figure 8**).

From this, the WLA for the city of Fort Scott defined at sample site 208 is 72.7 lbs/day BOD, the WLA for the Fort Scott Campground is 0.2 lbs/day BOD and the WLA for the Maple Ridge MHP 0.08 lbs/day across all flow conditions (**Figure 8**).

The city of Fort Scott is under a schedule of compliance to upgrade its waste treatment facility (adding a mechanical treatment system to its current lagoon system) by March 31, 2004. The system upgrade should not only reduce the BOD load in its effluent by 75% over the current system, but the effluent will also be re-aerated after denitrification resulting in DO of 6 mg/L in the effluent. The BOD load reduction by the city of Fort Scott should be sufficient to meet the BOD endpoint of 2.9 mg/L at water quality sampling site 208.

Because of the indications that low flow and temperature are driving factors causing the occasional excursion from the water quality standard rather than BOD at monitoring site 559, point sources upstream of this site are not seen as a significant source of DO excursions. In order to meet in stream DO levels during the critical summer months, the cities of Moran and Bronson should be required to reduce their discharge during these very low flow periods (generally, July and August). Based on this reduction, Streeter-Phelps analysis indicates the present BOD permit limit for each these point sources (Moran, Bronson, and Uniontown) maintains DO levels above 5 mg/L for flows greater than or equal to the 7Q10 of 0.1 cfs and is therefore assumed to correspond to maintaining the historical average BOD concentration of 2.4 mg/L or less at monitoring site 559 across this flow condition and achieves the Kansas Water Quality Standard for DO of 5 mg/L. The sum of the design flows of the point sources (0.32 cfs) redefines the lowest flow seen at site 559 (93-99% exceedence), and the WLA (plus a background LA) equals the TMDL curve across this flow condition (**Figure 9**).

From this, the WLA for the city of Moran defined at sampling site 559 is 2 lbs/day BOD, the WLA for the city of Bronson is 1.3 lbs/day and the WLA for the city of Uniontown is 0.9 lbs/day BOD across all flow conditions (**Figure 9**).

Non-Point Sources: Based on the assessment of sources, the distribution of excursions from water quality standards at site 208 as compared to site 207 and 559 and the relationship of those excursions to runoff conditions and seasons, non-point sources are also seen as a primary factor contributing to the DO excursions under certain conditions in the watershed between monitoring sites 559 and 208. The samples from the Marmaton River at site 208 show there were no DO violation at flows in excess of 86 cfs. The Load Allocation assigns responsibility for reducing the in stream BOD levels at site 208 to 2.9 mg/L across the 4.66 - 68 cfs range of the critical flow condition and maintaining the in stream BOD levels at site 208 to the historical levels of 5.7 mg/L for flow in excess of 68 cfs (which is 90th percentile of BOD samples for flows above 68 cfs in the Marmaton River near the KS - MO state line). A background LA was established at site 208 based on the BOD target of 2.9 mg/L and the 7Q10 of 0.1 cfs. The background LA across all flow conditions is 1.57 lbs/day BOD. Therefore, the sum of these two LA is 1.57 lbs/day for flows from 0 - 4.66 cfs (83 - 99% exceedence) and then increases as the LA increases for flows greater than 4.66 cfs to the TMDL curve (**Figure 8**). Sediment control practices such as buffer strips and grassed waterways should help reduce the non-point source BOD load under higher flows as well as reduce the oxygen demand exerted by the sediment transported to the stream that may occur during the critical flow period.

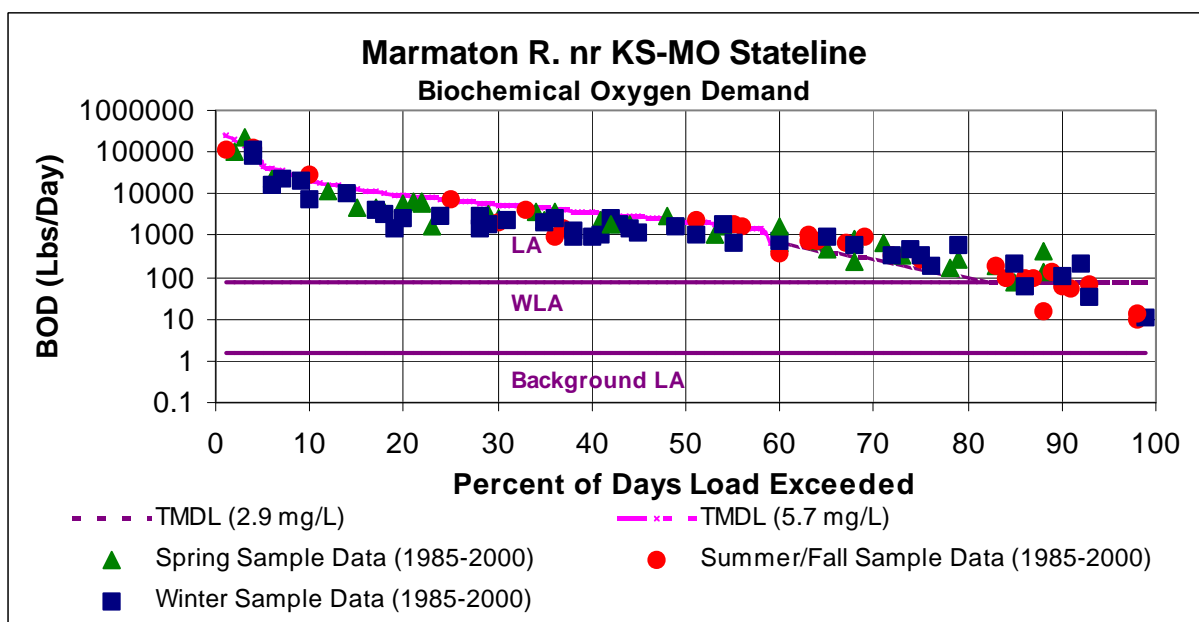


Figure 8

Because of the indications that low flow and temperature are the driving factors causing the occasional excursion from the water quality standard at site 559 rather than BOD, non-point sources are also not seen as a significant source of DO excursions in the watershed above site 559. The Load Allocation assigns responsibility for maintaining the historical average in stream

BOD levels at site 559 to 2.4 mg/L or less for flows greater than 0.32 cfs (0-92% exceedence). A background LA was established at site 559 based on the BOD target of 2.4 mg/L and the 7Q10 of 0.1 cfs. The background LA across all flow conditions is 1.3 lbs/day BOD. Therefore, the sum of these two LA is 1.3 lbs/day for flows from 0 - 0.32 cfs (93 - 99% exceedence) and then increases as the LA increases for flows greater than 0.32 cfs to the TMDL curve (**Figure 9**).

To address the occasional DO violations outlined in Table 2 at water quality sampling site 559, riparian vegetation restoration should occur adjacent to the main stem and buffer strips should be installed on directly contributing tributaries to provide shade for the stream and filter sediment before reaching the stream.

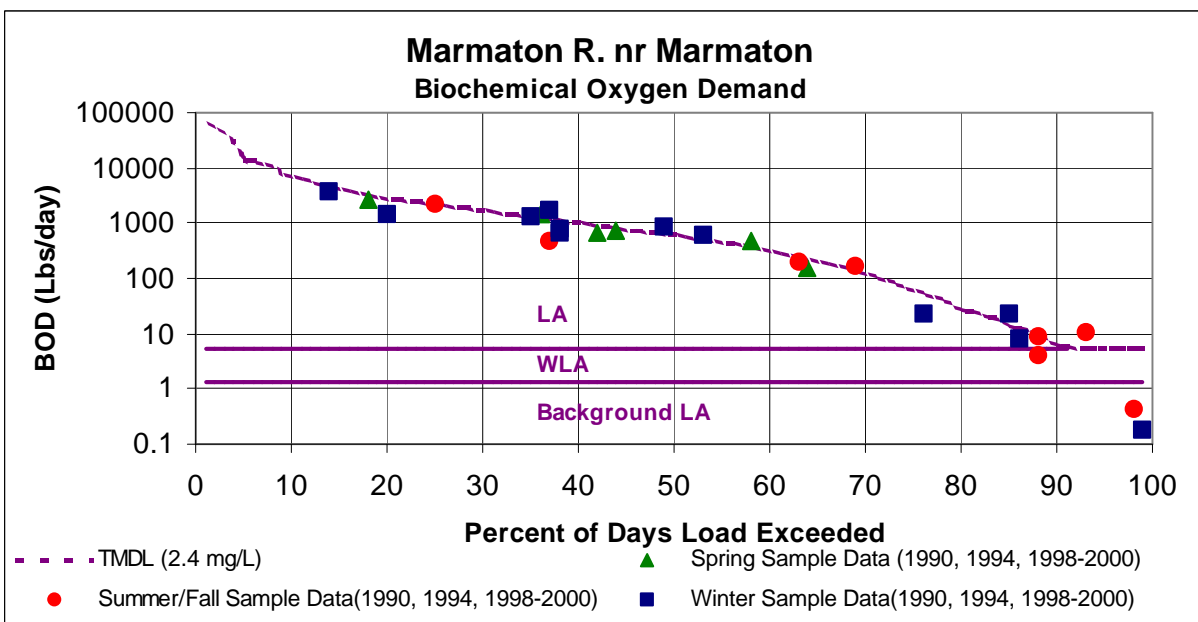


Figure 9

Defined Margin of Safety: The Margin of Safety will be implied based on conservative assumptions used in the permitting of the point source discharges including coincidence of low flow with maximum discharge from the treatment plant, associated CBOD content and temperature of the effluent, and the better than permitted performance of the treatment plant in producing effluent with BOD well below permit limits under critical seasonal conditions.

State Water Plan Implementation Priority: Because this watershed has indicated some problem with dissolved oxygen which has short term and immediate consequences for aquatic life, this TMDL will be a High Priority for implementation.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Marmaton River Subbasin (HUC 8: 10290104) with a priority ranking of 17 (High Priority for restoration work).

Priority HUC 11s and Stream Segments: Because of this watershed's DO problem is at site 208, the point and non-point sources in HUC 14s 10290104010080, 10290104020010, and 10290104020020 which includes main stem stream segments 5, 7, and 8 within these HUC14s should be the focus of priority. Upstream of site 559, priority focus should be directed toward

baseflow generating and conducting stream segments; the main stem (segment 12) and listed contributing tributaries, with diminishing priority as distance from site 559 increases.

5. IMPLEMENTATION

Desired Implementation Activities

1. Renew state and federal permits and inspect permitted facilities for permit compliance
2. Install proper manure and livestock waste storage
3. Install grass buffer strips where needed along contributing tributaries.
4. Insure proper on-site waste system operations in proximity to main streams.
5. Insure that labeled application rates of chemical fertilizers are being followed
6. Where needed, upstream of site 559, restore riparian vegetation along main stem.

Implementation Programs Guidance

NPDES and State Permits - KDHE

- a. Municipal permits for facilities in the watershed will be renewed after 2002 with continuation of DO and BOD monitoring and permit limits preventing excursions in these criteria, especially during the identified critical flow periods.
- b. Livestock permitted facilities will be inspected for integrity of applied pollution prevention technologies.
- c. Registered livestock facilities with less than 300 animal units will apply pollution prevention technologies.
- d. Manure management plans will be implemented.

Non-Point Source Pollution Technical Assistance - KDHE

- a. Support Section 319 demonstration projects for pollution reduction from livestock operations in watershed.
- b. Provide technical assistance on practices geared to small livestock operations which minimize impact to stream resources.
- c. Provide technical assistance in urban and agricultural setting on practices geared to minimize chemical fertilizer impact to stream resources.
- d. Guide federal programs such as the Environmental Quality Improvement Program, which are dedicated to priority subbasins through the Unified Watershed Assessment, to priority watersheds and stream segments within those subbasins identified by this TMDL.

Water Resource Cost Share & Non-Point Source Pollution Control Programs - SCC

- a. Provide alternative water supplies to small livestock operations

- b. Develop improved grazing management plans
- c. Reduce grazing density on pasturelands
- d. Install livestock waste management systems for manure storage
- e. Implement manure management plans
- f. Install replacement on-site waste systems
- g. Coordinate with USDA/NRCS Environmental Quality Improvement Program in providing educational, technical and financial assistance to agricultural producers.

Riparian Protection Program - SCC

- a. Design winter feeding areas away from streams.
- a. Develop riparian restoration projects along main stem and tributaries upstream of site 559, especially those areas with baseflow.

Buffer Initiative Program - SCC

- a. Install grass buffer strips near streams.
- b. Leverage Conservation Reserve Enhancement Program to hold riparian land out of production.

Extension Outreach and Technical Assistance - Kansas State University

- a. Educate livestock producers on riparian and waste management techniques.
- b. Educate chemical fertilizer users on proper application rates and timing.
- c. Provide technical assistance on livestock waste management design.
- d. Continue Section 319 demonstration projects on livestock management.

Agricultural Outreach - KDA

- a. Provide information on livestock management to commodity advocacy groups.
- b. Support Kansas State outreach efforts.

Local Environmental Protection Program - KDHE

- a. Inspect on-site waste systems within one mile of priority stream segments (5, 7, and 8).

Timeframe for Implementation: Pollution reduction practices should be installed within the priority subwatersheds over the years 2002-2006, with follow up implementation thereafter.

Targeted Participants: Primary participants for implementation will be the City of Fort Scott, agricultural producers with land adjacent to stream, and small livestock producers operating without need of permits within the priority watershed. Implemented activities should be targeted at those areas with greatest potential to impact the stream. Nominally, this would be activities located within one mile of the priority streams including:

1. Facilities without water quality controls
2. Unbuffered cropland adjacent to streams

3. Sites where drainage runs through or adjacent livestock areas
4. Sites where livestock have full access to stream and stream is primary water supply
5. Poor riparian sites
6. Sites which have an urban runoff component
7. Failing on-site waste systems
8. Areas of denuded riparian vegetation along the main stem and contributing tributaries upstream of monitoring site 559.

Some inventory of local needs should be conducted in 2002 to identify such activities. Such an inventory would be done by local program managers with appropriate assistance by commodity representatives and state program staff in order to direct state assistance programs to the principal activities influencing the quality of the streams in the watershed during the implementation period of this TMDL.

Milestone for 2006: The year 2006 marks the mid-point of the ten year implementation window for the watershed. At that point in time, milestones should be reached which will have at least two-thirds of the landowners responsible for the facilities and sites cited in the local assessment participating in the implementation programs provided by the state. Additionally, sampled data from sites 208 and 559 should indicate evidence of improved dissolved oxygen levels at the critical flow conditions relative to the conditions seen over 1990-2000. At this early stage of implementation the establishment of riparian vegetation and buffer strips is important and it is acknowledged that, in the case of riparian vegetation, it may take 20 years and beyond to provide a shade canopy over the stream.

Delivery Agents: The primary delivery agents for program participation will be the conservation districts for programs of the State Conservation Commission and the Natural Resources Conservation Service. Producer outreach and awareness will be delivered by Kansas State Extension and agricultural interest groups such as Kansas Farm Bureau or Kansas Livestock Association, the Kansas Pork Producers Council and the Kansas Dairy Association. On-site waste system inspections will be performed by Local Environmental Protection Program personnel for Bourbon county.

Reasonable Assurances:

Authorities: The following authorities may be used to direct activities in the watershed to reduce pollution.

1. K.S.A. 65-164 and 165 empowers the Secretary of KDHE to regulate the discharge of sewage into the waters of the state.
2. K.S.A. 65-171d empowers the Secretary of KDHE to prevent water pollution and to protect the beneficial uses of the waters of the state through required treatment of sewage and established water quality standards and to require permits by persons having a potential to discharge pollutants into the waters of the state.

3. K.A.R. 28-16-69 to -71 implements water quality protection by KDHE through the establishment and administration of critical water quality management areas on a watershed basis.
4. K.S.A. 2-1915 empowers the State Conservation Commission to develop programs to assist the protection, conservation and management of soil and water resources in the state, including riparian areas.
5. K.S.A. 75-5657 empowers the State Conservation Commission to provide financial assistance for local project work plans developed to control non-point source pollution.
6. K.S.A. 82a-901, *et seq.* empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of the state.
7. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the *Kansas Water Plan*.
8. The *Kansas Water Plan* and the Marais des Cygnes Basin Plan provide the guidance to state agencies to coordinate programs intent on protecting water quality and to target those programs to geographic areas of the state for high priority in implementation.

Funding: The State Water Plan Fund, annually generates \$16-18 million and is the primary funding mechanism for implementing water quality protection and pollution reduction activities in the state through the *Kansas Water Plan*. The state water planning process, overseen by the Kansas Water Office, coordinates and directs programs and funding toward watersheds and water resources of highest priority. Typically, the state allocates at least 50% of the fund to programs supporting water quality protection. This TMDL is a High Priority consideration.

Effectiveness: Current point source controls appear effective in maintaining low BOD levels in wastewater discharged to streams. Non-point source controls for livestock waste have been shown to be effective in reducing pollution in locales such as the Herrington Lake watershed. Buffer strips are being touted as a significant means for protection of streams and riparian restoration projects are also being touted as a significant means for water temperature buffers of streams.. Public education campaigns can change behavior regarding urban fertilizer application rates. The key to effectiveness is participation within a finite subwatershed to direct resources to the activities influencing water quality. The milestones established under this TMDL are intended to gauge the level of participation in those programs implementing this TMDL.

Should participation significantly lag below expectations over the next five years or monitoring indicates lack of progress in improving water quality conditions from those seen over 1990-2000, the state may employ more stringent conditions on agricultural producers and urban runoff in the watershed in order to meet the desired endpoints expressed in this TMDL. The state has the authority to impose conditions on activities with a significant potential to pollute the waters of the state under K.S.A. 65-171. If overall water quality conditions in the watershed deteriorate, a Critical Water Quality Management Area may be proposed for the watershed, in response.

6. MONITORING

KDHE will continue to collect bimonthly samples on a four year rotation at Station 559 and bimonthly at Station 208 including dissolved oxygen samples. Based on that sampling, the status of 303(d) listing will be evaluated in 2010. Should impaired status remain, the desired endpoints under this TMDL will be refined and more intensive sampling will need to be conducted under specified seasonal flow conditions over the period 2005-2009.

Monitoring of BOD levels in effluent will be a condition of NPDES and state permits for facilities. This monitoring will continually assess the functionality of the systems in reducing nutrient levels in the effluent released to the streams.

Local program management needs to identify its targeted participants of state assistance programs for implementing this TMDL. This information should be collected in 2002 in order to support appropriate implementation projects.

7. FEEDBACK

Public Meeting: The public meeting to discuss TMDLs in the Marais des Cygnes Basin was held February 28, 2001 in Ottawa. An active Internet Web site was established at <http://www.kdhe.state.ks.us/tmdl/> to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Marais des Cygnes Basin.

Public Hearings: Public Hearings on the TMDLs of the Marais des Cygnes Basin were held in Fort Scott on May 30 and Ottawa on May 31, 2001.

Basin Advisory Committee: The Marais des Cygnes Basin Advisory Committee met to discuss the TMDLs in the basin on October 4, 2000, February 28 and May 30, 2001.

Milestone Evaluation: In 2006, evaluation will be made as to the degree of implementation which has occurred within the watershed and current condition of the Marmaton River. Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.

Consideration for 303(d) Delisting: The river will be evaluated for delisting under Section 303(d), based on the monitoring data over the period 2005-2009. Therefore, the decision for delisting will come about in the preparation of the 2010 303(d) list. Should modifications be made to the applicable water quality criteria during the ten year implementation period, consideration for delisting, desired endpoints of this TMDL and implementation activities may be adjusted accordingly.

Incorporation into Continuing Planning Process, Water Quality Management Plan and the Kansas Water Planning Process: Under the current version of the Continuing Planning Process, the next anticipated revision will come in 2002 which will emphasize revision of the Water Quality Management Plan. At that time, incorporation of this TMDL will be made into both documents. Recommendations of this TMDL will be considered in *Kansas Water Plan* implementation decisions under the State Water Planning Process for Fiscal Years 2002-2006.